MULTIMEDIA UNIVERSITY

STUDENT ID NO

MULTIMEDIA UNIVERSITY

FINAL EXAMINATION

TRIMESTER 1, SESSION 2022/2023 (TERM ID 2210)

EEL4116 – POWER STATIONS

(LE)

13 FEBRUARY 2023
9:00 AM – 11:00 AM
(2 Hours)

INSTRUCTIONS TO STUDENT

1. This Question Paper consists of four pages including the cover page with five Questions only.

2. Answer **ALL** questions. All questions carry equal marks and the distribution of the marks for each question is given.

3. Please print all your answers in the Answer Booklet provided.

Question 1

(a) From the perspective of the utility, why is load factor so important? [6 marks]

(b) Table 1(b) shows the load characteristics of a small village:

Table 1(b)

Time	12am-7am	7am-11am	11am-2pm	2pm-6pm	6pm-8pm	8pm-12am
Load (kW)	30	50	30	70	90	50

(i) Construct the load curve and estimate the load factor of the plant. [8 marks]

(ii) Draw the load duration curve and estimate the peak and base loads. [6 marks]

Question 2

(a) Table 2(a) illustrates the top ranked nations according to the Energy Trilemma Index 2021. Identify the 3 components of the index which dictates the ability of each country to produce sustainable energy. Deduce the main reason of why Malaysia is not among the top ranked nations.

[5 marks]

Table 2(a): Energy Trilemma Index 2021

Index rank	Country	Trilemma score
1	Sweden	84.2
2	Switzerland	83.8
3	Denmark	83
4	Finland	81.7
4	United Kingdom	81.7
5	France	81.1
5	Austria	81

(b) Country X is setting a goal of moving up the ranks in Table 2(a). In terms of power generation, it has narrowed down to two options of either setting up a coal fired power plant or a nuclear power plant. Assess which is the better option. Justify your selection. [10 marks]

(c) Recommend FIVE measures which can be undertaken to improve the efficiency of existing coal-fired power plants. [5 marks]

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Question 3

(a) The Three Gorges Dam is the world's largest hydropower station in terms of installed capacity. It has the potential to generate more than 100TWh of electricity per year. Construction started in 1994 and subsequently the power plant has been fully functional since 2012.

(i) It was reported that the full cost of the construction of the Three Gorges Dam can be recouped in about 10 years after commencement of its full operation. What is the main reason which makes this possible? [4 marks]

(ii) Ideally, what would the advantages of the Three Gorges Dam? Name THREE of them. [3 marks]

(iii) Identify THREE disadvantages of the Three Gorges Dam project. [3 marks]

(b) The Edra Melaka Power Plant is the largest combined cycle gas turbine (CCGT) power plant in Southeast Asia. Explain how CCGT works. [6 marks]

(c) Outline TWO characteristics of a site which makes diesel power station a viable option. [4 marks]

Question 4

(a) Your client requires you to design a substation for a rural and highly isolated building. You are given a very limited budget for this project. Design a substation which is most suitable given the constrain. Clearly illustrate and label all components in your design. Finally, explain THREE disadvantages of your design. [10 marks]

(b) In a country with tropical climate such as Malaysia, designing and installation of substations has to be done with several factors to be considered. One of the factors is fault. Compose FIVE most prevalent causes of fault to substations in Malaysia. Create potential solution for each of the cause of fault that you have identified. [10 marks]

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Question 5

(a) For the year 2021, a factory operates for 20 hours a day and its average monthly load is as shown in Table 5(a).
The plant has monthly maximum demand of 350kW at 0.75 power factor. Given that the tariff is as follows:

- For each kW of maximum demand per month: RM29.60/kW
- For all kWh: RM0.337/kWh
- The minimum monthly charge is RM600.00

Table 5(a)

Month	Average Monthly Load (kW)
January	0
February	250
March	320
April	300
May	330
June	310
July	320
August	340
September	290
October	310
November	300
December	330

(i) Calculate the total cost of power consumption in a year. [8 marks]

(ii) If a power factor surcharge of 1.5% of the current bill for every 0.01 less than 0.85 is imposed, what would be the new total cost of power consumption in a year now? [4 marks]

(iii) What can be done to prevent the surcharge in (ii)? [2 marks]

(b) List down THREE guiding principles of an electricity tariff system. [6 marks]

End of Paper.